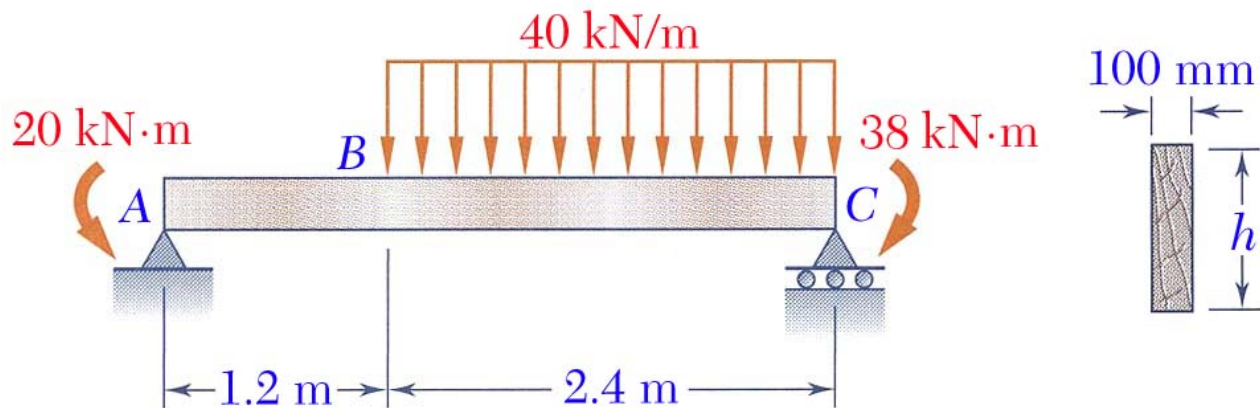


MEEG 3013 Quiz #5

A timber beam is shown. (a) Using singularity functions, find the magnitude and location of the maximum bending moment M_{\max} in the beam. (b) If $\sigma_{\text{all}} = 12 \text{ MPa}$ and only beams with cross section of 100-mm width and depth h varying from 300 mm to 500 mm in 10-mm increments are available, select the most economical cross section that can be used.



$$\mathbf{A}_y = 27 \text{ kN } \uparrow \quad \textcircled{2} \quad (\mathbf{C}_y = 69 \text{ kN } \uparrow)$$

$$q = -20 \langle x \rangle^{-2} + 27 \langle x \rangle^{-1} - 40 \langle x - 1.2 \rangle^0 \quad \textcircled{2}$$

$$V = -20 \langle x \rangle^{-1} + 27 \langle x \rangle^0 - 40 \langle x - 1.2 \rangle^1 \quad \textcircled{1}$$

$$M = -20 + 27x - 20 \langle x - 1.2 \rangle^2 \quad \textcircled{1}$$

$$V_D = 0 \ \& \ M_D = 21.5125 \text{ kN}\cdot\text{m} \text{ at } x_D = 1.875 \text{ m from A}$$

(a) $M_{\max} = 21.5 \text{ kN}\cdot\text{m}$ at $x_D = 1.875 \text{ m}$ from A. $\textcircled{2}$

(b) $\because h_{\min} = 328 \text{ mm}$, we select the one with $h = 330 \text{ mm}$. $\textcircled{2}$